

THE AMMONITE *STOLICZKAIA* FROM THE CENOMANIAN OF ENGLAND AND NORTHERN FRANCE

by C. W. WRIGHT and W. J. KENNEDY

ABSTRACT. *Stoliczkaia* Neumayr, 1875, a predominantly Upper Albian genus of world-wide occurrence, is represented in the Lower Cenomanian of England and northern France by a species of the subgenus *S. (Shumarinaia)* Matsumoto and Inoma, 1975, and by two species referred to a new subgenus, *S. (Lamnayella)* Wright and Kennedy nov. This new subgenus is shown to include the previously described *S. texana* (Cragin), *S. uddeni* Böse, *S. crotaloides* (Stoliczka), and *S. clavigera* Neumayr. *S. (Lamnayella)* probably evolved from *S. (Stoliczkaia)* by development of juvenile stages with a more markedly fastigiate venter, a feeble siphonal tubercle, middle growth stages with markedly bullate narrow strong ribs which either branch from bullae or are intercalated between primaries, and a mature stage with strong, distant, narrow, predominantly long ribs. It is an independent development parallel to, but distinct from, the contemporaneous *Paracalyoceras* Spath, 1925.

THE genus *Stoliczkaia* was introduced by Neumayr in 1875 for a group of Cretaceous ammonites with ribbed inner whorls and relatively smooth outer whorls. It included species now referred to *Fagesia* (e.g. *Ammonites rudra* Stoliczka) and *Neoptychites* (e.g. *Ammonites telinga* Stoliczka) as well as to *Stoliczkaia* as now conceived.

Diener (1925, p. 179) designated d'Orbigny's *Ammonites dispar* as type species and the genus has generally been taken as indicative of a world-wide *Stoliczkaia dispar* Zone at the top of the Albian stage (e.g. Spath 1923a, b, 1923c–1943; Arkell *et al.* 1957). At various times, however, there have been records of the genus in association with Lower Cenomanian fossils, especially in parts of Texas and northern Mexico (e.g. Böse 1927; Adkins 1928) and, more recently, South America (Reyment and Tait 1972, p. 84) and Japan (Matsumoto and Inoma 1975). In all of these areas, precise dating of this pre-eminent Albian genus is difficult due to poor stratigraphical control (e.g. Japan, Brazil) or the endemic nature of associated faunas (Texas and Mexico) and the only records which are placed in the European standard are the *Stoliczkaia* sp. juv. and *Stoliczkaia* sp. nov. recorded by Hancock (1959) from the Cenomanian stratotype and by Kennedy (1969, 1970, 1971) from southern England. These and other recently discovered English and French specimens of Cenomanian *Stoliczkaia* are described below as new species of a new subgenus *S. (Lamnayella)* nov. and the recently described *S. (Shumarinaia)* Matsumoto and Inoma.

SYSTEMATIC PALAEOLOGY

Superfamily ACANTHOCERATAEAE Hyatt, 1900

Family LYELLICERATIDAE Spath, 1921

Subfamily STOLICZKAIIINAE Breistroffer, 1953

Genus STOLICZKAIA Neumayr, 1875

Type species. *Ammonites dispar* d'Orbigny, 1841, by subsequent designation by Diener (1925, p. 179). The holotype of this poorly understood species is figured here photographically for the first time (text-fig. 1).



TEXT-FIG. 1. *a, b. Stoliczkaia (Stoliczkaia) dispar* (d'Orbigny). Holotype, Renaux Collection, Laboratoire de Paléontologie des Invertébrés, Université des Sciences et Techniques de Montpellier. 'Gres vert-sur le versant du sud au pied de Ventoux'. Original figured by d'Orbigny 1841, pl. 45, figs. 1, 2, $\times 0.63$.

Diagnosis. Small to medium-sized lyelliceratids, typically compressed and moderately involute (although depressed and evolute species are known) with bi- or trituberculate venters when juvenile, ventral tuberculation being lost at an early stage in some species but surviving to maturity in others. Ornament consists of primary ribs, rarely bullate at the umbilical shoulder, separated by one or several shorter intercalated ribs; all the ribs are continuous across the venter. Some species maintain well-developed ribs to maturity; in others the outer whorls are essentially smooth or bear only broad low fold-like ribs.

Occurrence. World wide, Upper Albian and Lower Cenomanian.

Subgenus LAMNAYELLA nov.

Type species. *Stoliczkaia (Lamnayella) juigneti* sp. nov. Lower Cenomanian, Lamnay, France and Wilmington, Devon, England.

Derivation of name. The subgenus is named from the village of Lamnay in Sarthe, France, source of the majority of the type series.

Diagnosis. Medium sized (adult at *c.* 60 mm) *Stoliczkaia* with fastigate venter which is feebly trituberculate when young and evenly rounded when mature. Feeble umbilical bullae give rise to single (rarely paired) strong, narrow, high, distant, feebly flexed, prorsiradiate ribs, with from one to three shorter intercalated ribs during early and middle growth. On body chambers, most ribs are long, strong, narrow and distant. The suture has broad, rounded, slightly incised elements.

Discussion. Three subgenera of *Stoliczkaia* have been proposed in addition to the nominate group; typical examples of these are shown in Plates 36, 37, and 39 and text-fig. 1. They may be differentiated from *Lamnayella* as follows: *S.* (*Stoliczkaia*) (text-fig. 1, Pl. 36, figs. 7–9, 12–13), the nominate subgenus, represented by species such as *S.* (*S.*) *dispar* (d'Orbigny) (text-fig. 1, Pl. 36, figs. 12–13) is compressed and involute, with bituberculate inner whorls (Pl. 36, figs. 7–9). Ribbing is low, dense and crowded; ventral tubercles are lost during middle growth (Pl. 36, fig. 13), and the venter becomes rounded. Normally before the beginning of the mature body chamber there is a more or less sudden change in the ribbing; the ribs become more distant and rounded. Thereafter (text-fig. 1), all ornament declines, leaving a smooth body chamber with low broad folds only. Typical species in addition to *S.* (*S.*) *dispar* are *S.* (*S.*) *clavigera* Neumayr, *S.* (*S.*) *undulosa* Breistroffer, *S.* (*S.*) *tennis* Renz, and *S.* (*S.*) *dorsetensis* Spath.

S. (*Faraudiella*) Breistroffer, 1947 (Pl. 36, figs. 5–6), type species *Ammonites blancheti* Pictet and Campiche, 1859 by original designation. Involute, compressed, with dense, low crowded ribs. Trituberculate venter angular, with siphonal in addition to ventral clavi, which are retained in middle growth stages, although mature body chambers develop low, broad fold-like ribs with only a feeble siphonal tubercle or none surviving. In addition to *S.* (*F.*) *blancheti* (of which *S.* (*F.*) *gardonica* (Hébert and Munier-Chalmas) may be a synonym), *S.* (*F.*) *rhammonota* (Seeley) is referred to the subgenus as is *S.* (*F.*) *sexangulata* (Seeley) in which ventro-lateral and siphonal tubercles are retained to maturity.

S. (*Shumarinaia*) Matsumoto and Inoma, 1975 (Pl. 38, figs. 19–21), type species *S.* (*Sh.*) *hashimotoi* Matsumoto and Inoma, 1975 by original designation. Very small, evolute, compressed, with ribs sparse, very broad and low, with umbilical bullae and sometimes incipient ventral tubercles; some species develop a tabulate venter with blunt ventral tubercles on the body chamber. *S.* (*Sh.*) *hashimotoi* and *S.* (*Sh.*) *asiatica* Matsumoto and Inoma are diminutive species, adult at less than 40 mm, with greatly reduced sutures. *S.* (*Sh.*) *africana* (Pervinquière) reaches a larger size.

S. (*Villoutreysia*) Casey, 1965 (Pl. 36, figs. 10–11). Type species *S.* (*V.*) *villoutreysi* Casey, 1965 by original designation. Casey differentiated this subgenus by its broad, square venter, strong, persistent ribbing, and generally narrower and shallower umbilicus. On comparing the type species with numerous *S.* (*Stoliczkaia*) from both England and France, we conclude that the features of *S.* (*V.*) *villoutreysi* are of specific significance only. The species is close to *S.* (*S.*) *dorsetensis* Spath.

From these remarks it can be seen that the distinctive features of *S.* (*Lamnayella*) are the evolute coiling, relatively low expansion rate, initially feebly trituberculate but later rounded venter, long and short (rarely branched), distant, sometimes bullate ribs which are retained to maturity and remain sharp, distant, narrow and high even on the

mature body chamber. In addition to the type species, the following are referred to the subgenus:

S. (L.) crotaloides Stoliczka, 1865.

S. (L.) sanctaecatherinae sp. nov.

S. (L.) tetragona Neumayr, 1875.

S. (L.) texana (Cragin, 1893) (of which *S. uddeni* Böse 1927 appears to be a synonym).

In addition we would suggest that *Stoliczkaia* aff. *dispar* Böse (1927, p. 212 (pars.) pl. 5, figs. 1–3) may be a *Lamnayella*.

A number of genera are closely related to *S. (Lamnayella)*. *Paracalycoceras* Spath, 1925 (type species *Ammonites wiestii* Sharpe, 1857) (Pl. 36, figs. 1–4) has rather similar inner whorls though with more distinct ventral tubercles, but the body chamber bears very characteristic low broad blunt distant rursiradiate ribs, some of which bear strong bullae. These features differentiate it from *S. (Lamnayella)* but the genus is presumed to be descended from *Stoliczkaia*, and could well be regarded as no more than a further subgenus of *Stoliczkaia*.

A second Lower Cenomanian descendant of *S. (Faraudiella)* is the endemic North American genus *Budaiceras* Böse, 1927 (type species *Budaiceras mexicanum* Böse, 1927 by original designation). Here, however, ribbing is low and flexuous, and there are prominent ventro-lateral and siphonal clavi throughout ontogeny; the latter become twice as numerous as the ribs on the outer whorl.

More problematic are the relationships between *S. (Lamnayella)* and *Cottreautes* Collignon, 1929 (type species *Acanthoceras (Prionotropis) subvicinale* Boule, Lemoine and Thévenin, 1907, by original designation) (text-fig. 2a–c). This genus is based on pyritic nuclei only and has alternately long and short ribs, sometimes branching from umbilical bullae, with inner and outer ventro-lateral and siphonal tubercles in the type species at least. Collignon (1928–1929) and Sornay (1955) have described a range of other species, some with trituberculate peripheries, others with ventral tubercles and a siphonal keel. Whilst the presence of inner ventro-lateral in addition to outer ventro-lateral and siphonal tubercles suffices to differentiate the type species and thus the genus from *S. (Lamnayella)* and other subgenera of *Stoliczkaia*, other species referred to *Cottreautes* may subsequently prove to be nuclei of other species and genera based on larger limestone moulds.

EXPLANATION OF PLATE 36

Figs. 1–4. *Paracalycoceras wiestii* (Sharpe). WW 3556, from the *Mantelliceras saxbii* assemblage Zone fauna of division A2 of the Cenomanian Limestone, White Cliff, Seaton, Devon.

Figs. 5, 6. *Stoliczkaia (Faraudiella) rhamnonota* (Seeley). Holotype, Sedgwick Museum, Cambridge. From the *Stoliczkaia dispar* Zone fauna of the Cambridge Greensand, Cambridge.

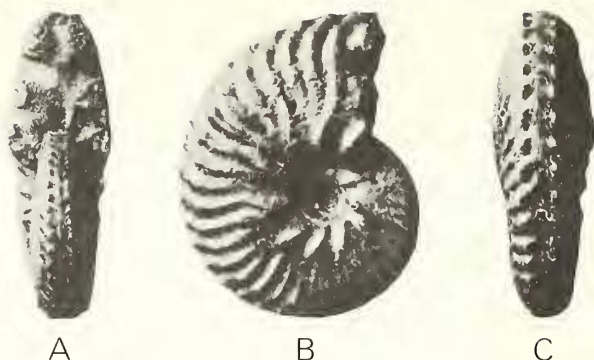
Figs. 7–9. *Stoliczkaia (Stoliczkaia) tenuis* Renz. U.S. National Museum no. 237003, from the *Stoliczkaia dispar* Zone of Porto Amboin, Angola.

Figs. 10, 11. *Stoliczkaia ('Villoutreysia') villoutreysi* Casey. Holotype, O. de Villoutreys Collection, Upper Albian, Monte Carlo Tunnel, Monte Carlo.

Figs. 12, 13. *Stoliczkaia (Stoliczkaia) dispar* (d'Orbigny). WW 72344, from the phosphatic fauna of the *dispar* Zone Ammonite Bed, Upper Greensand, White Nothe, Dorset. All figures $\times 1$.



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TEXT-FIG. 2. *a-c. Acanthoceras (Prionotropis) subvicinale* Boule, Lemoine, and Thévenin. Type species of the genus *Cottreauites* Collignon 1929. Copy of Boule, Lemoine, and Thévenin 1907, pl. 8, fig. 5*a-c.* $\times 2$.

Occurrence. *S. (Lamnayella)* is known from England, France, Texas, Mexico, Japan and southern India, and has a proven stratigraphic distribution which extends throughout the western European *Hypoturrilites carcitanensis* assemblage Zone to the base of the succeeding *Mantelliceras saxbii* assemblage Zone, whilst there are questionable fragments from somewhat higher levels. Records elsewhere suggest a restriction to the lower parts of the Lower Cenomanian in Texas and Mexico (Grayson Marl, Del Rio Clay and Buda Limestone). Japanese material comes from a horizon close to the Albian–Cenomanian boundary. The age of the Indian species, which are from Moraviatoor, is not precisely known; they are said to be from the Utatur Group and may be of either late Albian or Cenomanian date. A fragment comparable with the Indian *S. (L.) crotaloides* has been found in the Upper Albian *Mortoniceras (Durnovarites) perinflatum* Subzone in Dorset.

Stoliczkaia (Lamnayella) juigneti sp. nov.

Plate 37, figs. 1–10; Plate 38, figs. 1–12

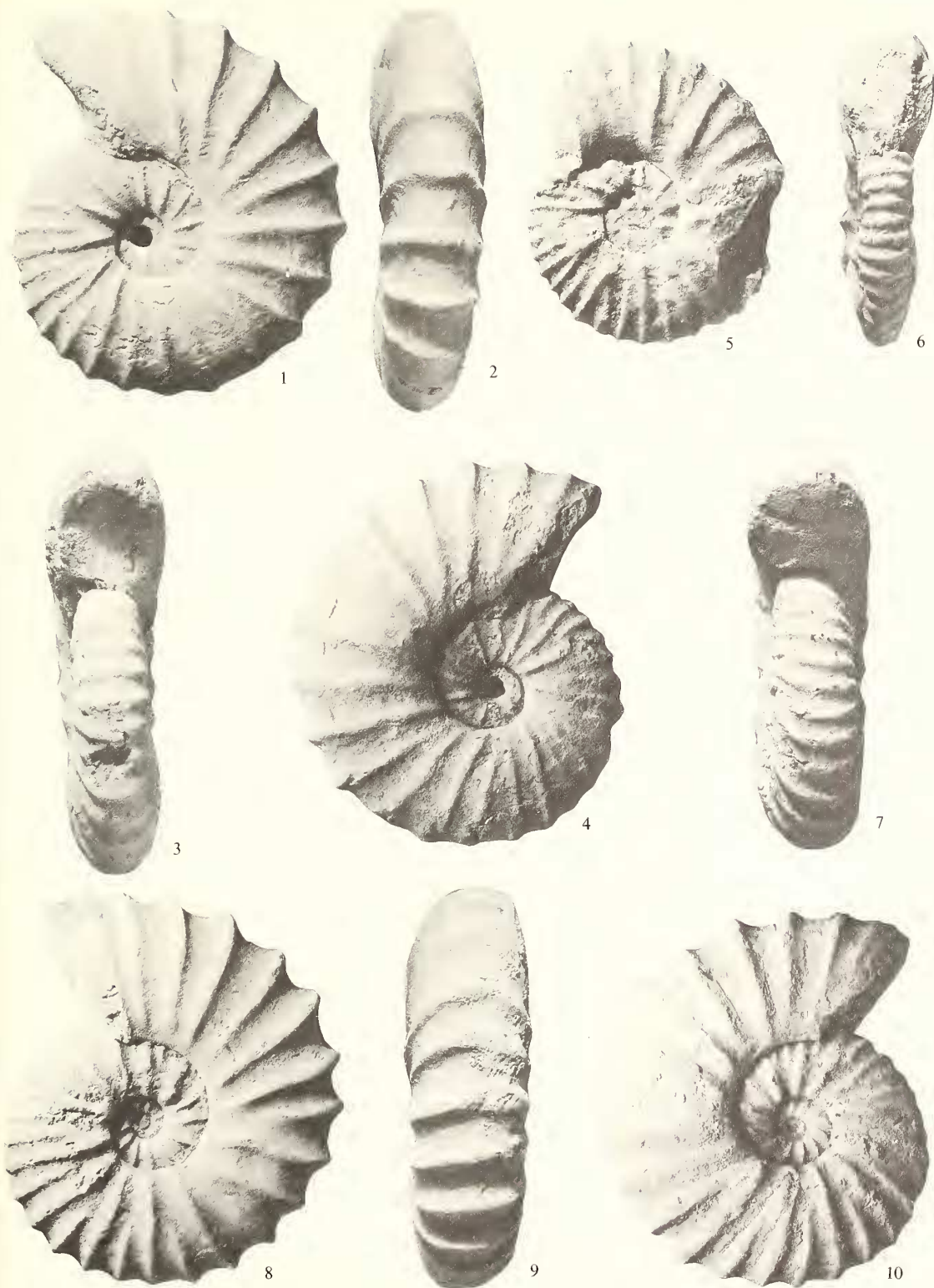
1959 *Stoliczkaia* sp. nov. Hancock, p. 249.

1971 '*Stoliczkaia*' sp. nov. Kennedy, p. 106.

Types. The holotype is specimen L1 in the Collections of the Muséum d'Histoire Naturelle, Paris, figured on Plate 37, figs. 1–4. Paratypes are L2–L4 and FSM 117 and 173 from the Lower Cenomanian Craie Glauconieuse à *Pecten asper* of Lamnay, Sarthe, at the boundary between the *Hypoturrilites carcitanensis* and *Mantelliceras saxbii* assemblage Zones. Paratype WW 15275 is of the same age, and from the Basement Bed of the Wilmington Sands at Hutchin's Pit, Wilmington, Devon (Grid Reference ST 216003; see Kennedy 1970, p. 661 for details).

EXPLANATION OF PLATE 37

Figs. 1–10. *Stoliczkaia (Lamnayella) juigneti* gen. et. sp. nov. 1–4, the holotype, L1. 5, 6, paratype, FSM 117. 7–10, paratype L3. All specimens from the Lower Cenomanian *Hypoturrilites carcitanensis*–*Mantelliceras saxbii* Zone passage beds, Craie Glauconieuse à *Pecten asper*, Lamnay, Sarthe. All figures $\times 1$.



WRIGHT and KENNEDY, ammonoid *Stoliczkaia*

Derivation of name. The species is named after our good friend Pierre Juignet of Caen who has done so much to clarify the stratigraphy of the Cenomanian of Sarthe.

Dimensions. All dimensions are in millimetres; figures in parentheses are individual measurements as a percentage of diameter. D = diameter; Wb = whorl breadth; Wh = whorl height; U = umbilical diameter from seam to seam; Ru = ribs at umbilical shoulder; Rt = total ribs; c and ic refer to costal and intercostal measurements respectively.

		D	Wb	Wh	Wb/Wh	U	Ru	Rt
L1	c	61.3(100)	16.2(26)	22.5(37)	72	18.9(31)	19	28
	ic	61.3(100)	14.8(24)	21.5(35)	69	18.9(31)	19	28
L2	c	45.9(100)	13.9(30)	18.1(39)	77	14.0(31)	18	32
	ic	45.9(100)	12.5(27)	16.7(36)	75	14.0(31)	18	32
L3	c	60.4(100)	16.4(27)	23.3(38)	70	19.2(32)	18	29
	ic	60.4(100)	14.4(24)	21.7(36)	66	19.2(32)	18	29
L4	c	40.7(100)	— (—)	17.4(43)	—	10.0(25)	15	30
	ic	40.7(100)	— (—)	16.3(40)	—	10.0(25)	15	30
WW 15275	c	41.7(100)	13.3(32)	14.8(35)	90	9.1(22)	15	—
	ic	41.7(100)	12.6(30)	13.3(32)	94	9.1(22)	15	—

Diagnosis. A compressed, parallel-sided *Lamnayella* with a feebly trituberculate venter up to the middle growth stages, bearing 28–32 ribs per whorl. There are fifteen weakly bullate primary ribs with one to three shorter intercalated ribs during middle growth and long distant ribs only on the adult body chamber.

Description. The holotype and other paratypes from Lamnay are all distorted composite moulds. Only the Wilmington paratype is undeformed, and this retains traces of recrystallized shell. During middle growth the coiling is moderately evolute, with approximately 40% of the previous whorl being covered; at maturity the degree of evolution increases, the last part of the body chamber being markedly eccentric (Pl. 37, figs. 1, 4, 8, 10). The umbilicus is shallow and of moderate breadth (dimensions above) with a low wall and broadly rounded shoulder.

EXPLANATION OF PLATE 38

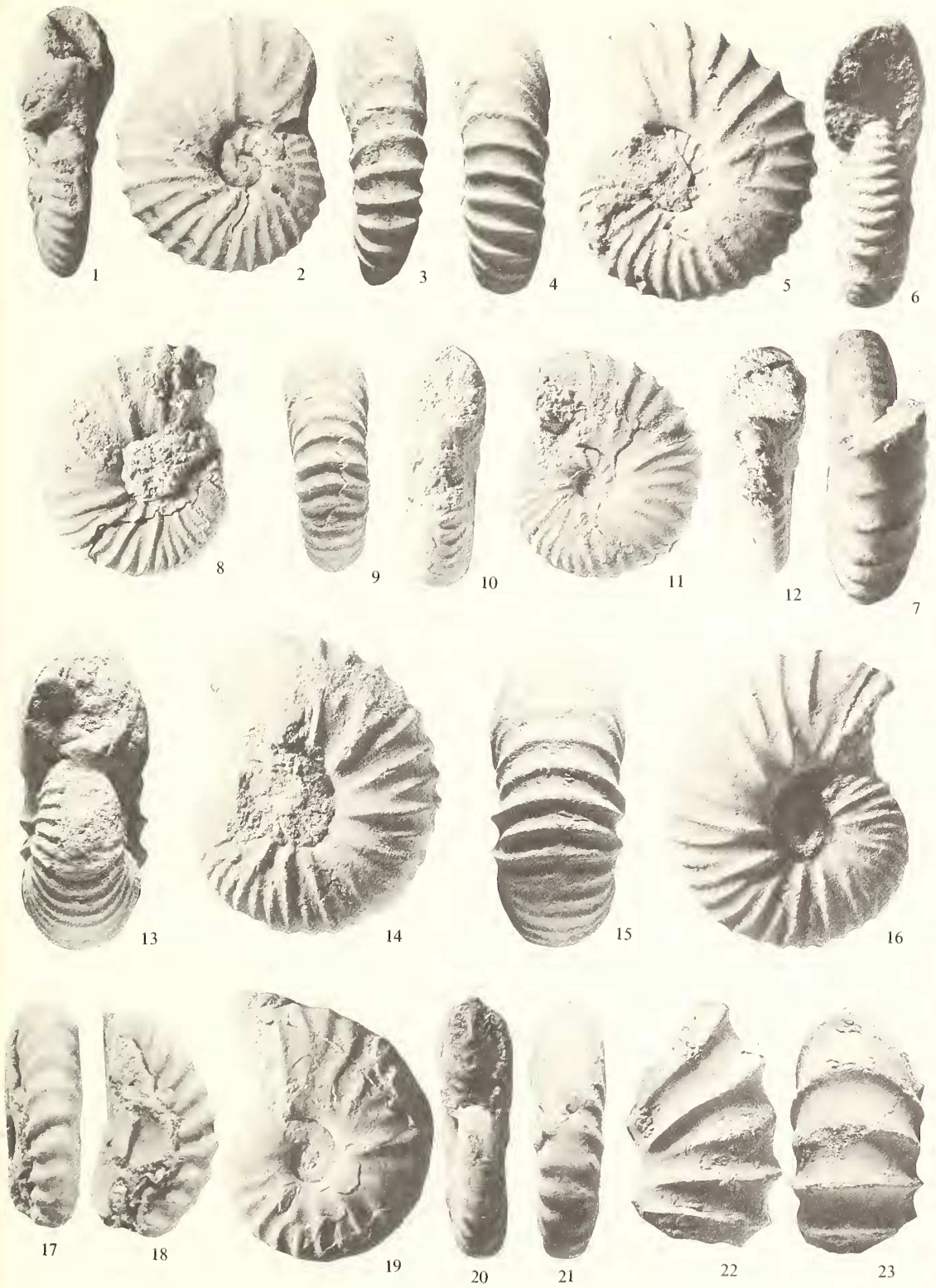
Figs. 1–12. *Stoliczkaia (Lamnayella) juigneti* subgen. et sp. nov. 1–3, paratype L4. 4–7, paratype L3, both from the Lower Cenomanian *Hypoturrilites carcitanensis*–*Mantelliceras saxbii* Zone passage beds, Craie Glauconieuse à *Pecten asper*, Lamnay, Sarthe. 8–12, paratype WW 15275, of the same age, from the Basement Bed of the Wilmington Sands, Hutchin's Pit, Wilmington, Devon.

Figs. 13–16, 22, 23. *Stoliczkaia (Lamnayella) sanctaecatherinae* gen. et. sp. nov. 4a–d, the holotype, WW 9863 and 7a, b, paratype WW 9887, both from the phosphatic Lower Cenomanian *Hypoturrilites carcitanensis* assemblage Zone fauna of the Glauconitic Marl at Rocken End, Gore Cliff, Isle of Wight, Hampshire.

Figs. 17, 18. *Stoliczkaia (Shumarinaia) cf. asiatica* Matsumoto and Inoma. J. M. Hancock Collection, no. CC 451, from the Lower Cenomanian *Mantelliceras saxbii* Zone fauna of the Marnes de Ballon exposed 3.35 km east of Ballon, Sarthe, France.

Figs. 19–21. *Stoliczkaia (Shumarinaia) asiatica* Matsumoto and Inoma. Holotype, Geological Collections, Kyushu University, no. TKD 30173A, from the Middle Yezo Group of Shumarinai, Hokkaido, Japan.

Figs. 1–16, 22, 23, $\times 1$; figs. 17–21, $\times 2$.



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The whorl section is a compressed oval. The greatest breadth is low on the inner flank in intercostal section and at, or just outside, the bulla in costal section. The inner flanks are broadly rounded and the outer flanks converge to a venter which is narrowly rounded in intercostal section, without distinctly demarcated shoulders, and weakly fastigate in costal section during early growth stages, but rounded later.

Fifteen to eighteen ribs of variable strength arise at the umbilical seam and pass straight up the low umbilical wall. Feeble umbilical bullae of variable strength are present (cf. Pl. 37, fig. 5 and Pl. 38, figs. 7, 11) giving rise to one rib, or rarely a pair (Pl. 37, fig. 5). The ribs are prorsiradiate, narrow, acutely rounded, straight on the inner flank, but gently flexed from mid flank (Pl. 37, figs. 1, 4), projected slightly forwards (and as a result weakly concave) over the outer flank, strengthening to cross the venter with a faint but distinct convex flexure. Between these long ribs are from one (typically) to three (exceptionally) shorter intercalated ribs, most arising some way below mid flank and sometimes tenuously linked to a bulla or to the umbilicus by faint striae. Initially weak, these ribs strengthen across the outer flank, following a similar course and of similar elevation to that of the primary ribs when traced across the venter.

Up to 25–30 mm diameter, the venter is distinctly if weakly fastigate (Pl. 38, figs. 6, 7, 10, 12), with a ventro-lateral angulation and poorly defined tubercles, much weaker than the faint siphonal tubercle. These suggest a distinctively trituberculate juvenile stage (our specimens do not show the development at less than 20 mm diameter). From approximately 30 mm onwards the venter is evenly rounded and from 40 mm onwards the primary ribs dominate, becoming distant, high and narrow, with bullae declining markedly, so that ribs are connected to the umbilicus by little more than striae in some cases (Pl. 37, fig. 1). At the mature aperture, ribbing weakens and the last few ribs are crowded (Pl. 37, figs. 1, 4, 8, 10).

Only the Wilmington paratype shows the suture line, which is incompletely exposed. It is rather simple with broad, little-incised bifid elements.

Discussion. Compressed whorl section, alternation of long and short ribs during middle growth and dominance of long ribs at maturity separate *S. (L.) juigneti* from *S. (L.) sanctaecatherinae* sp. nov., described below, and *S. (L.) tetragona* Neumayr (text-fig. 3a, b). *S. (L.) crotaloides* Stoliczka (text-fig. 3c–e) has mainly long ribs, which are distinctively flexuous, and a curious middle growth stage with a tabulate venter and looped ribs. *S. (L.) texana* (Pl. 38, figs. 1–8) is the closest species, but it is more robust, has a higher expansion rate and predominantly long ribs during middle and later growth, the ribs recti- to rursiradiate and convex, rather than prorsiradiate and concave as in our species.

Occurrence. *S. (L.) juigneti* is known only from the boundary beds between the *Hypoturrilites carcitanensis* and *Mantelliceras saxbii* assemblage zones of Lamnay, Sarthe, France, and Wilmington, Devon, England.

Stoliczkaia (Lamnayella) sanctaecatherinae sp. nov.

Plate 38, figs. 13–16, 22, 23; Plate 39, figs. 9–11; text-fig. 4a–c

pars 1969 '*Stoliczkaia*' spp., Kennedy, p. 467.

1970 *Lyelliceratidae* gen. et. sp. nov., Kennedy, p. 622.

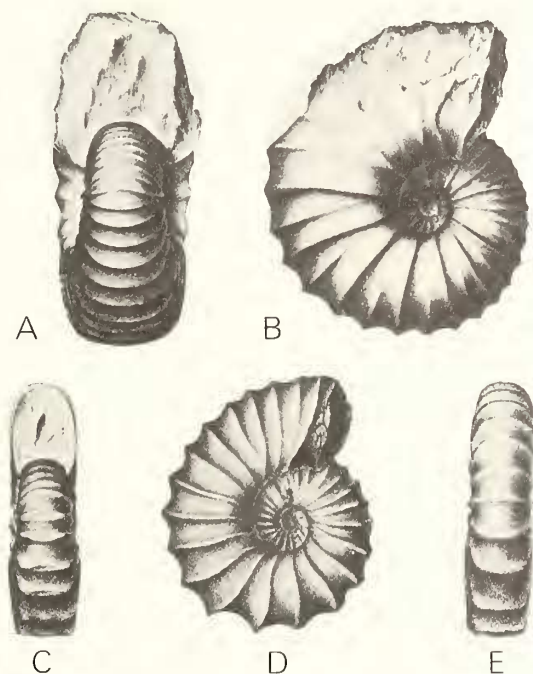
Types. The holotype is WW 9863, from the phosphatic fauna of the Glauconitic Marl exposed in fallen blocks at Rocken End, below Gore Cliff, Isle of Wight, Hampshire (SZ 492755; see Kennedy 1969, p. 525 for details), as is paratype WW 9887; paratype OUM K4787 is from the same horizon at Head Ledge, Eastbourne, Sussex (TV 595955; see Kennedy 1969, p. 506 for details); paratype OUM K4788 is from the same horizon at Stour Bank, near Blandford Forum, Dorset (ST 846106; see Kennedy 1970, p. 622 for details). Two additional specimens tentatively referred to the species are OUM K4789-4790 from the unphosphatized fauna of the Glauconitic Marl at Beddingham Limeworks near Lewes, Sussex (TQ 440073; see Kennedy 1969, p. 50 for details). All specimens are of Lower Cenomanian, *Hypoturrilites carcitanensis* assemblage Zone age.

Derivation of name. From St. Catherine's Point, source of the holotype.

Dimensions.

		D	Wb	Wh	Wb/Wh	U	Ru	Rt
WW 9863	c	47.7(100)	20.3(43)	18.8(39)	1.08	12.9(27)	14	35
	ic	47.7(100)	18.9(40)	17.7(37)	1.07	12.9(27)	14	35

Diagnosis. An inflated *Lamnayella* with fastigate trituberculate venter during early growth. Middle growth stages have strong umbilical bullae giving rise to groups of two or three strong, narrow, high, distant prorsiradiate ribs which loop across the flanks and venter. Additional intercalated ribs are also present. Ribbing simplifies on the mature body chamber.



TEXT-FIG. 3. *a, b. Stoliczkaia (Lamnayella) tetragona* Neumayr. Copy of Stoliczka 1865, pl. 45, fig. 2-2a, $\times 0.5$. *c-e. Stoliczkaia (Lamnayella) crotaloides* (Stoliczka). Copy of Stoliczka 1865, pl. 46, fig. 3-3b, $\times 0.5$.

Description. The holotype and paratypes are all phosphatic internal moulds. The early stages, at a diameter of approximately 15 mm, are shown by OUM K4788 (Pl. 39, figs. 12, 13). The whorl section is compressed with rather flattened convergent flanks and a fastigiate venter. Ornament consists of both primary and intercalated ribs, all of which bear distinct ventral clavi, connected across the venter by a broad convex rib, which bears a feeble siphonal tubercle.

At an estimated diameter of 25 mm this juvenile morphology has changed, and in middle and later growth stages (Pl. 38, figs. 13–16) ventral tuberculation is lost. The coiling is quite evolute, becoming increasingly so at maturity (Pl. 38, figs. 14, 16). The umbilicus is moderately deep and wide (27% of diameter). The umbilical wall is of moderate height, rounded and with an evenly rounded shoulder. The whorl section is slightly depressed, with the greatest breadth at the umbilical bullae in costal section and just below mid flank in intercostal section. The inner flanks are somewhat swollen; the outer flanks converge to a broadly rounded and somewhat flattened venter. There are fourteen umbilical bullae per whorl, most of them high and narrow, giving rise to groups of two or three ribs, which separate from the bulla on the inner third of the flank. There are also occasional weaker bullae giving rise to a single rib, and some non-bullate ribs which extend almost to the umbilicus as mere striae, whilst there may also be one or two shorter intercalated ribs inserted between long ribs, arising low on the flank. All ribs are prorsiradial, narrow, high and distant, with a slight forwards projection and concavity on the outer flank, strengthening and broadening across the venter which they pass straight across or with slight convex curvature. Groups of long ribs generally loop between bullae (Pl. 38, fig. 15); in general, the central rib of groups of three or the front rib of pairs arising from bullae is the strongest.

Towards the aperture of the holotype the whorl contracts markedly and the ribbing simplifies, suggesting it to be close to maturity; in paratype WW 9887, a body chamber fragment, the whorls are slightly compressed (coastal Wb:Wh = 0.9) (Pl. 38, figs. 22–23).

The suture is simple, with broad, rounded, little-incised elements.

Discussion. The available material shows some variation in whorl section and coarseness of ribbing, but the species is characterized by the distinctive style of ribbing and the strong bullae, which serve to distinguish it from the more slowly expanding *S. (L.) juigneti* sp. nov., in which the bullae are weak and generally give rise to simple ribs only. *S. (L.) texana* (Pl. 39, figs. 1–8) also lacks strong bullae and grouped ribs, having an oval whorl section, a predominance of alternately long and short ribs in youth, and

EXPLANATION OF PLATE 39

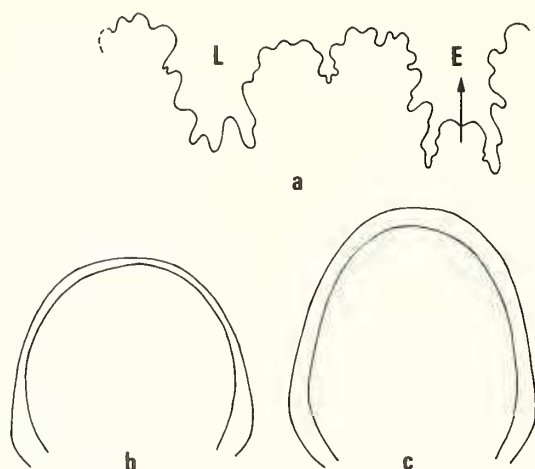
Figs. 1–8. *Stoliczkaia (Lamneyella) texana* (Cragin). 1–3, lectotype, Texas Memorial Museum, Austin, no. 19731. 4–6, no. 19740a. 7–8, no. 19740b; probable paralectotypes, all from the 'Vola Limestone' of Denton County, Texas (Grayson Marl or Buda Limestone: Lower Cenomanian).

Figs. 9–13. *Stoliczkaia (Lamneyella) sanctaecatherinae* gen. et. sp. nov. Paratype OUM K4788, from the Lower Cenomanian *Hypoturrilites carcitanensis* assemblage Zone phosphatic fauna of the Glauconitic Marl at Stour Bank, Dorset.

Figs. 1–11, $\times 1$; 12–13, $\times 3$.



WRIGHT and KENNEDY, ammonoid *Stoliczkaia*



TEXT-FIG. 4. *Stoliczkaia* (*Lamnayella*) *sanctae-catherinae* sp. nov. a, partial external suture $\times 3$, and b, whorl section $\times 1.5$, of the holotype, WW 9863; c, whorl section of paratype, WW 9887, $\times 1.5$.

simple feebly convex rursiradiate ribs during later growth. *S. (L.) crotaloides* (text-fig. 3c-e) also has predominantly simple flexuous flank ribs, typically lacks bullae, and has a curious tabulate venter with incipient looping in middle growth. In *S. (L.) tetragona* (text-fig. 38a, b), the most similar species, there is also looping of ribs, but the Indian species lacks bullae, has a quadrate whorl section and faintly rursiradiate convex ribs rather than the prorsiradiate feebly concave ribs of our species. The ventral ribs are thin and straight or concave in *S. (L.) tetragona* rather than thickened and convex as in our form.

Occurrence. The species is known only from the Lower Cenomanian *Hypoturrilites carcitanensis* assemblage Zone of Dorset, Hampshire, and Sussex, England.

Stoliczkaia (*Lamnayella*) sp.

Material. Seven unregistered specimens from the Marnes de Ballon, tranchée de la Gare, Montmirail, Sarthe, preserved in the collections of the Sorbonne.

Remarks. These seven fragments belong to an *S. (Lamnayella)* with an oval whorl section and long primary ribs separated by up to three intercalated ribs. They are too poor for fuller determination, but are closest to *S. (L.) juigneti*.

Occurrence. Lower Cenomanian, high *H. carcitanensis* or low *M. saxbii* assemblage Zone, Montmirail, Sarthe, France.

Subgenus SHUMARINAIA Matsumoto and Inoma, 1975

Stoliczkaia (*Shumarinaia*) cf. *asiatica* Matsumoto and Inoma

Plate 38, figs. 17-18

- 1959 *Stoliczkaia* sp. juv. Hancock, p. 249.
- 1971 *Stoliczkaia* sp. juv. Kennedy, p. 106.
- cf. 1975 *Stoliczkaia* (*Shumarinaia*) *asiatica* Matsumoto and Inoma, p. 279, pl. 39, figs. 4-7; text-fig. 11.

Holotype. TKD 30173A, in the collections of the Department of Geology, Kyushu University, and from the Late Albian or early Cenomanian part of the Middle Yezo Group of Shumarinaï, Hokkaido, Japan.

Material. One specimen only, CC 451, in J. M. Hancock's collection from the Marnes de Ballon exposed in a ditch alongside the Ballon to Bonnetable Road, 3.35 km east of Ballon, Sarthe, France, and of Lower Cenomanian, low *M. saxbii* assemblage Zone age.

Description. The specimen is a composite mould of the body chamber of a small ammonite with an estimated maximum whorl height of 8 mm. The whorl section is compressed, with flattened parallel sides and a venter which is feebly fastigiate at the smaller end of the specimen and flattened at the larger. Ornament consists of blunt prorsiradiate ribs which are convex on the outer flank (the inner flanks are not preserved), thicken as they cross the venter and show distinct convex curvature. At the smallest diameter visible there are poorly defined ventral swellings.

Traces of the inner whorls are preserved as an external mould in the dorsum of the specimen; the whorls seem to have been flat-sided, compressed, with tiny ventral tubercles, giving the nucleus a 'submantellicerine' appearance.

Discussion. This tiny scrap was listed by both Hancock (1959) and Kennedy (1971) as *Stoliczkaia* sp. juv. Its affinities are clarified by the description of *S. (Shumarinaia)* by Matsumoto and Inoma (1975). It most closely resembles *S. asiatica* Matsumoto and Inoma, as can be seen from the holotype, refigured here as Plate 38, figs. 19–21. It differs chiefly in the more obviously differentiated ventral tubercles, but Japanese topotypes we have studied show this to be a somewhat variable feature in the species. *S. (Sh.) africana* (Pervinquière) and *S. (Sh.) hashimotoi* Matsumoto and Inoma are both more coarsely and robustly ornamented.

Occurrence. *S. (Sh.) asiatica* was originally described from the Middle Yezo Group of Hokkaido, Japan, where the age was no more precisely known than Uppermost Albian or Lower Cenomanian. The Sarthe specimen is of definite Lower Cenomanian age.

DISCUSSION

Descriptions of *S. (L.) juigneti* subgen. et sp. nov., *S. (L.) sanctaecatharinae* sp. nov., and *S. (Shumarinaia)* cf. *asiatica* Matsumoto and Inoma place records of *Stoliczkaia* from the European Cenomanian on a firm basis. They also clarify the age of the Japanese material, the date of which is not precisely defined.

Reference of *S. texana* (Cragin) and the related (if not conspecific) *S. uddeni* Böse to the subgenus further supports the view that the *Graysonites*-bearing strata which yield these species in Texas, Mexico and Japan are of Cenomanian rather than Albian age; unfortunately the evidence is still insufficient to correlate this level firmly with the European standard and to show whether or not it predates the earliest Cenomanian ammonite faunas of Europe (Kennedy 1971; Kennedy and Hancock 1977).

S. (Shumarinaia) is known definitely from the Upper Albian and Cenomanian. Accurately dated *S. (Lamnayella)* are all of Lower Cenomanian age, and it remains to suggest their evolutionary origins. The fastigiate, feebly trituberculate periphery of juvenile *Lamnayella* suggests that *Faraudiella* may be the ancestor, but this subgenus bears clearly defined clavi, rather than the blunt, poorly defined ventral tuberculation

of *Lamnayella*. It seems more likely that *Lamnayella* arose from *Stoliczkaia* sensu stricto, some species of which have fastigiate venters (e.g. Renz 1968, pl. 7, fig. 4a, b) which, with slight siphonal strengthening would produce the poorly defined or incipient siphonal tubercle of the present form. Furthermore, the ribbing pattern of *S. (Stoliczkaia)* of the *dorsetense* and *notha* groups (e.g. Spath 1923c-1943, pl. 32, fig. 7; Renz 1968, pl. 6, figs. 5a, b, 8a, b), if strengthened and maintained to maturity would closely resemble that of *Lamnayella*.

The small size of adult *Lamnayella* and also of *Shumarinaia* compared with *S. (Stoliczkaia)* forces one to consider whether these former may not be microconchs of the latter. However, *Lamnayella* and *Shumarinaia* both range from Upper Albian into Cenomanian whereas, to the best of our knowledge, typical *S. (Stoliczkaia)* do not. The balance of evidence at present is that *Shumarinaia* is a genuine dwarf offshoot and *Lamnayella* a small derivative of *S. (Stoliczkaia)* that persisted after the extinction of typical forms of the genus.

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